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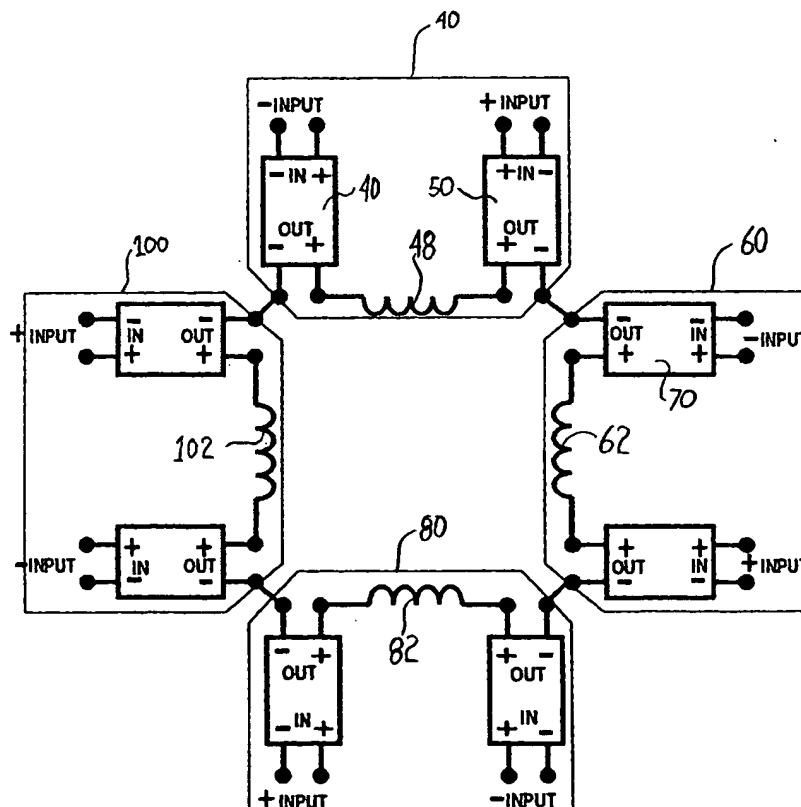
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[Continued on next page]

(54) Title: DISTRIBUTED CIRCULAR GEOMETRY POWER AMPLIFIER ARCHITECTURE



(57) Abstract: The present invention discloses a distributed power amplifier topology and device that efficiently and economically enhances the power output of an RF signal to be amplified. The power amplifier comprises a plurality of push-pull amplifiers interconnected in a novel circular geometry that preferably function as a first winding of an active transformer having signal inputs of adjacent amplification devices driven with an input signal of equal magnitude and opposite phase. The topology also discloses the use of a secondary winding that matches the geometry of primary winding and variations thereof that serve to efficiently combine the power of the individual power amplifiers. The novel architecture enables the design of low-cost, fully-integrated, high-power amplifiers in the RF, microwave, and millimeter-wave frequencies.



patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 01/31813

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H03F3/26 H03F3/42 H03F3/60

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H03F H01F H01P

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 283 685 A (MACMASTER GEORGE H ET AL) 11 August 1981 (1981-08-11) column 11, line 61 -column 12, line 37; figures 14,15 ---	1-43
A	US 5 920 240 A (ALEXANIAN ANGELOS ET AL) 6 July 1999 (1999-07-06) ---	
X	US 5 130 664 A (PAVLIC JOHN C ET AL) 14 July 1992 (1992-07-14) figure 3 ---	44
X	US 6 121 842 A (ZAITLIN MARK P ET AL) 19 September 2000 (2000-09-19) figures 2A,3B --- -/--	44

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents :

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

& document member of the same patent family

Date of the actual completion of the international search

6 June 2003

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17/06/03

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 556 398 A (ANRITSU CORP) 25 August 1993 (1993-08-25)	48,50,52
Y	figures 17,19B ---	47,48
X	DE 12 76 764 B (DEUTSCHES POST RUNDFUNK UND FE) 5 September 1968 (1968-09-05) figures 1,3 ---	46,52
X	FR 1 413 073 A (PORTENSEIGNE ETS MARCEL) 8 October 1965 (1965-10-08) figure 1A ---	46,52
Y	US 5 223 800 A (KARSTEN JR KENNETH S ET AL) 29 June 1993 (1993-06-29) figure 2 ---	47
Y	ROBERTSON I D ET AL: "SOLID STATE POWER AMPLIFIER USING IMPEDANCE-TRANSFORMING BRANCH-LINE COUPLERS FOR L-BAND SATELLITE SYSTEMS" PROCEEDINGS OF THE 23RD. EUROPEAN MICROWAVE CONFERENCE. MADRID, SEPT. 6 - 9, 1993, PROCEEDINGS OF THE EUROPEAN MICROWAVE CONFERENCE, TUNBRIDGE WELLS, REED EXHIBITION COMPANY, GB, 6 September 1993 (1993-09-06), pages 448-450, XP000629961 ISBN: 0-946821-23-2 figures 1,3 ---	48
A	US 4 305 043 A (HO PANG T ET AL) 8 December 1981 (1981-12-08) figure 6 ---	47
A	EP 0 379 202 A (FUJITSU LTD) 25 July 1990 (1990-07-25) -----	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 01/31813

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-44

A power amplifier comprising:
the two gain blocks of each push-pull amplifier are
interconnected at the positive terminals of their respective
output ports by an inductive path.

2. Claims: 45-52

A low loss inductor for deposition on a substrate.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US 01/31813

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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